

# Open Innovation and Technology Maturity Analysis

**U.S. Department of Defense (DoD)  
R&D and Technology Management**

**TMC 2007  
Sept 11-13, 2007**

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Report Documentation Page				Form Approved OMB No. 0704-0188	
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1. REPORT DATE <b>SEP 2007</b>		2. REPORT TYPE		3. DATES COVERED <b>00-00-2007 to 00-00-2007</b>	
4. TITLE AND SUBTITLE <b>Open Innovation and Technology Maturity Analysis</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Infologic, Inc.,1048 Irvine Avenue #624,Newport Beach,CA,92660</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES <b>See also ADM002182. Presented at the AFRL Technology Maturity Conference held in Virginia Beach, VA on 11-13 September 2007.</b>					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>48</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

# Agenda

## ART to SCIENCE ?

- I. Innovation Management:** Innovation Agenda for Public and Private Organizations: Concerns, Needs and Strategies, Why Innovation Management Art?, Need to convert to Science. Define an Innovation Management Model.
- II. Innovation Management: DoD R&D and Technology Management Process**  
Develop a framework which incorporates DoD Acquisition Management framework (e.g: TRLs), DoD Business Transformation strategies (e.g: Evolutionary Acquisition), GAO Recommendations (e.g: Knowledge-based Acquisition), DoD Community concerns & suggestions (e.g: Multi-Dimension Maturity Analysis, System of Systems integration), and Industry best practices (e.g: the Gate Process, CMMI, Technology Hype Cycle and Adoption Cycle).
- III. Knowledge-Based Gate Process:** An Art to Science process which may be employed by DoD R&D organizations and Program Managers to manage technologies through their life cycle. Introduce an Innovation Management methodology: TechIP ( Technology Insertion Plan )
- IV. Execution:** Strategies to implement the Framework and Process.

# Strategic Issues: Innovation Agenda

## Challenges

### ■ Innovation Agenda?

- Developing breakthrough products, revamping processes, and introducing improved or new business models.
- Emerging Technology Insertion & Integration.
- Open Innovation (export and import Intellectual Property (IP) and technologies).

### ■ Why Innovation Agenda?

- Private Organizations: Challenges of a flattened, competitive and information rich global economies (New consumers, shifting demographics, Global R&D and Technology villages and External & Global Intellectual Property (IP) sources).
- Public Organizations (DoD): Meeting the Security challenges of the 21<sup>st</sup> Century (Imperatives – Strategic, Technology, Threat and Risk Mitigation)

### ■ What Are we doing to meet these challenges?

# Strategic Issues: Meeting the Challenges

## Innovation Management Needs Recognized

■ **Private Organizations:** Recent Gartner Group, Deloitte and IBM studies have said Innovation is the “top of the mind” for corporate and public CEOs. Recent IBM study, titled: “Expanding the Innovation Horizon” concluded that:

- Business Model Innovation Matters: Business process innovation
- External Collaboration is Indispensable: Collaboration beyond the walls
- Innovation requires Orchestration from the top: Strategic commitments, teams, rewards and technology/process integration

■ **Public Organizations (DoD):** DoD Force Transformation:

- Support the Joint Warfighting Capability of the DoD
- Enable Rapid Access to Information for Strategic Decisions
- Reduce the Cost of Defense Business Operations
- Improve Financial Stewardship to the American People

# Strategic Issues: Innovation Management is Art

**Call to Action: An Innovation Management model which incorporates rigor, metrics and discipline**



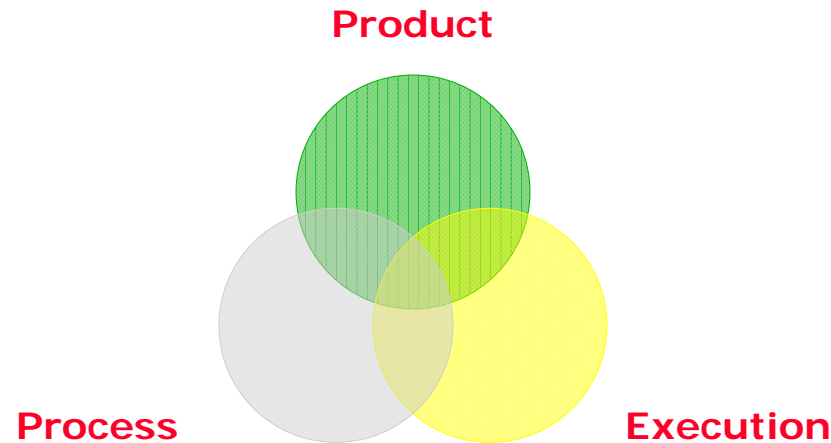
- Innovation should be held as same measurement rigor as other core functions.
- Innovation Opportunity Is About How the Process is Managed – Not Just Ideas and Creativity
- Improving Innovation is not Beyond Leaders' Control – It must be measured and controlled
- Key Innovation Mistakes: Not Emphasizing Speed, and Not Managing with Discipline and Aggressiveness



- Defense Transformation: Clear Leadership, Accountability, and Management Tools Are Needed to Enhance DOD's Efforts to Transform Military Capabilities [GAO-05-70](#)
- Best Practices: Stronger Practices Needed to Improve DOD Technology Transition Processes [GAO-06-883](#)

# Innovation Management Model

**Innovation = f (Product, Process, Execution)**



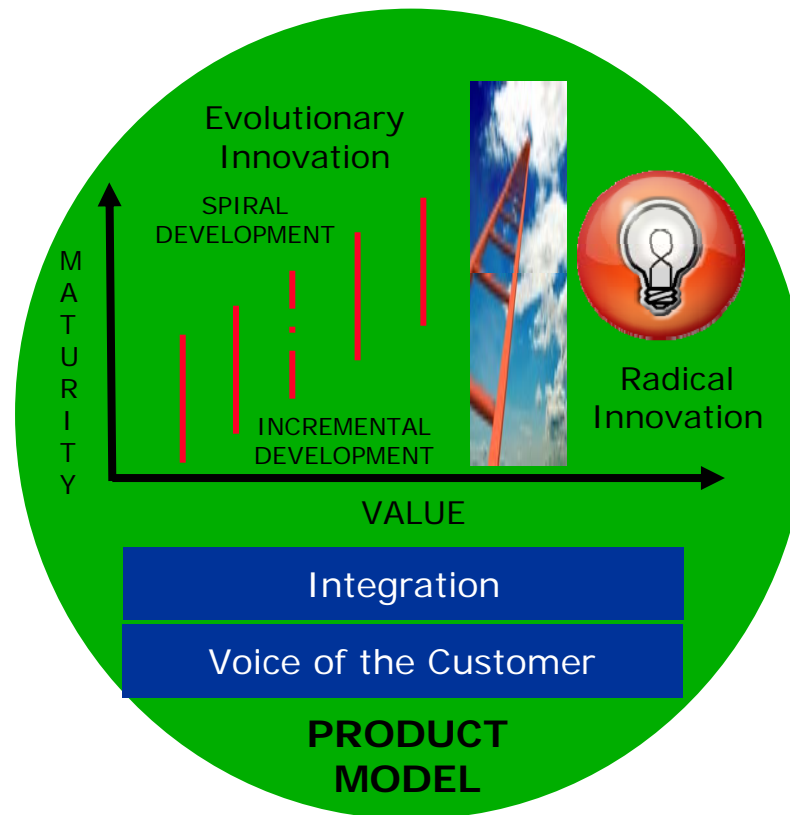
- **Product:** Technology-heavy (e.g: Airplane, iPod) OR Service-heavy (e.g: Starbucks System, eBay)
- **Process:** Any critical business process to ensure the success of product (e.g: iTunes for iPod, Marketing and Supply Chain Management)
- **Execution:** Management strategies to ensure that Innovation works! (WILL to ACT !!)

**To measure the success of Innovation in an organization, maturity analyses should be conducted for all THREE components:**

**Product, Process and Execution**

# Model: Product Maturity

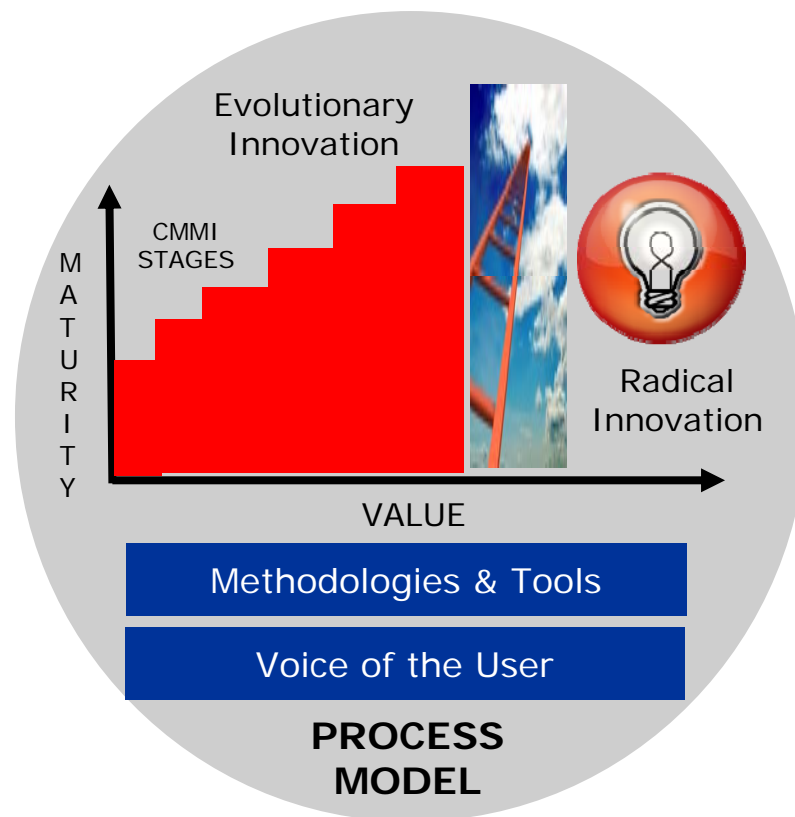
## Spiral Development, Multi-Dimension Maturity Analysis, Integration and Voice of the Customer





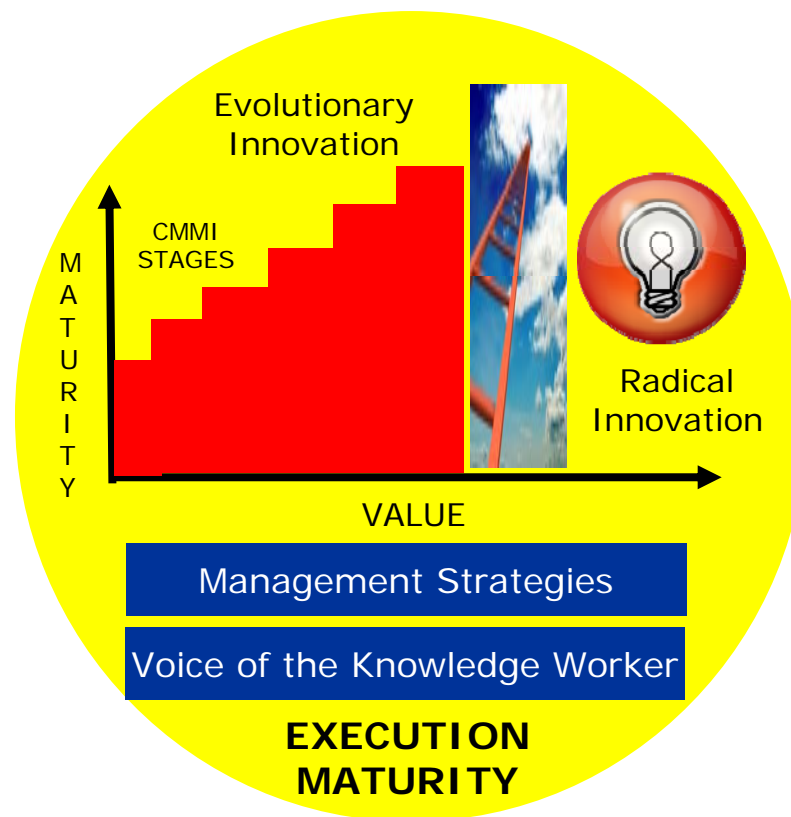
# Model: Process Maturity

**Model based on CMMI , Methodologies & Tools,  
and Voice of the User**



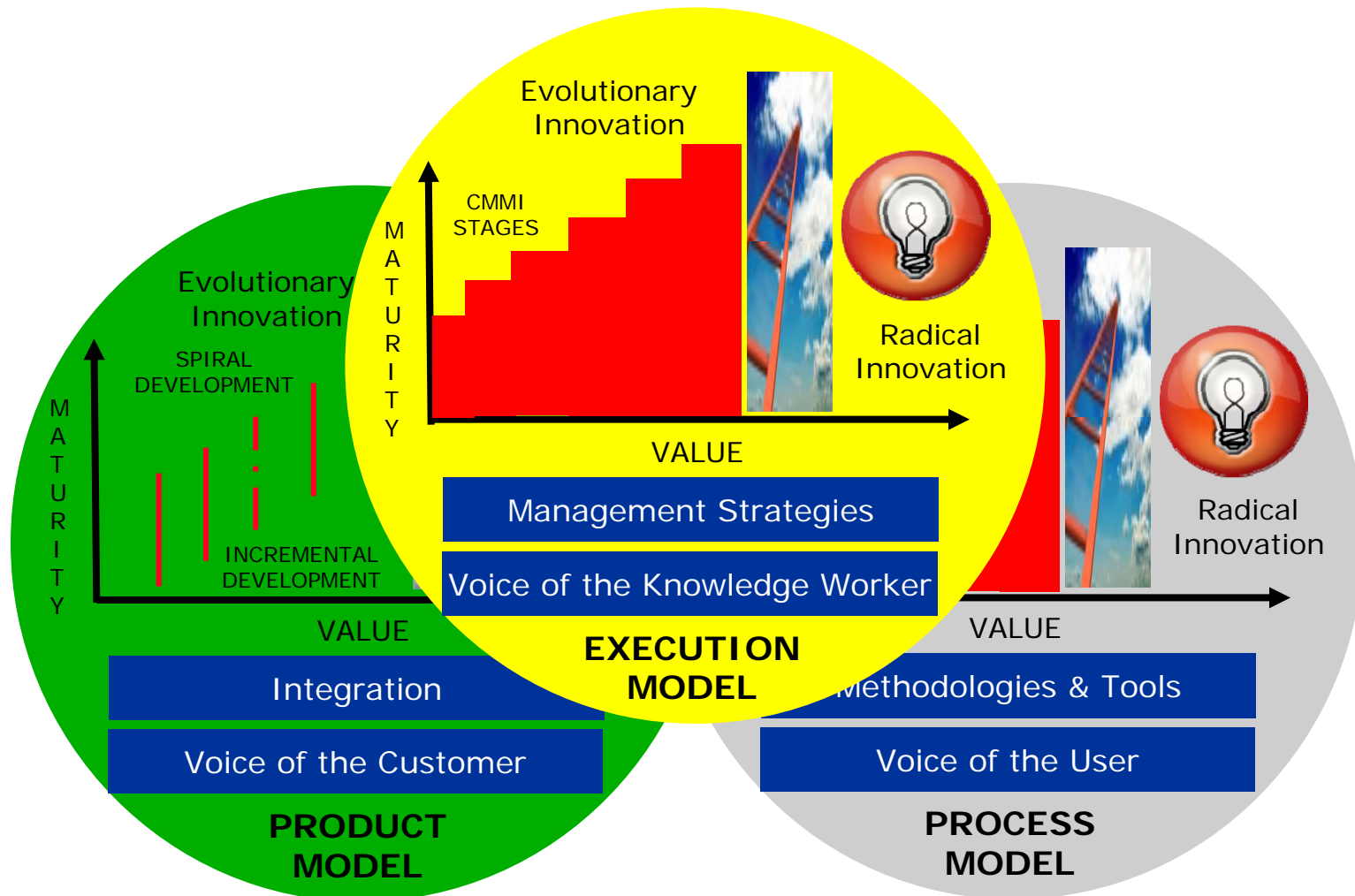
# Model: Execution Maturity

**Model based on CMMI , Management Strategies,  
and Voice of the Knowledge Worker**



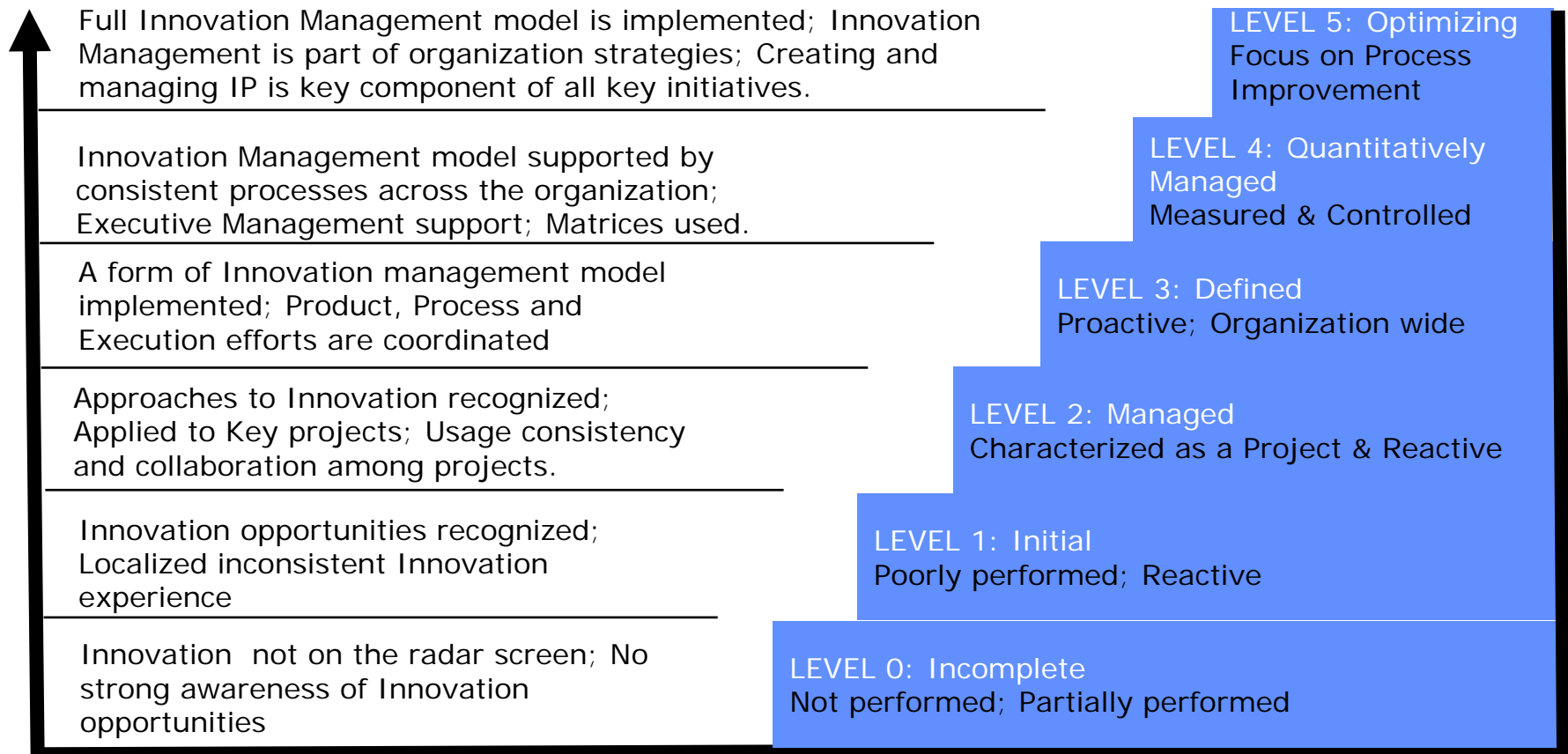
# Innovation Management Model: Components

**Innovation Maturity = f (Product, Process, Execution)**



# Innovation Management Model: Maturity

**Innovation Management is a Process and should be matured using the CMMI methodology**



# Innovation Model: Implementation

## An Innovation Model can be applied to varied functions of an Organization

### ■ Private Organizations

- Organization wide Innovation maturity – measure and control the whole organization's current level of maturity in adopting Innovation
- Product specific – measure and control Innovation in a given product (e.g: Idea to market for a given widget.)
- Process specific - measure and control Innovation in a given Process (e.g: Human Resource Management)

### ■ Public Organizations (DoD)

- Program Specific – measure the maturity of technologies and processes for a given Program through its life cycle (e.g: FCS)
- Sector Specific – measure the Innovation maturity of an organization (e.g: R&D and Technology Management)
- Initiative specific – measure the Innovation maturity for an Initiative (e.g: eGov)

# Agenda (Recap)

## ART to SCIENCE : A Framework

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# Innovation Management Process Pitfalls: DoD R&D and Technology Management

## Need Process Re-engineering

### ■ Generic

- Lack of Common technology maturation and risk control matrices (a la financial ratios)
- Gap between R&D Portfolios and Program technology needs
- Use of ad-hoc software tools which do not address the product or technology life cycle
- Lack industry “best practices”- The Gate Process, Technology Hype & Adoption Cycles
- Undefined relationship management (between R&D and Program Management)

### ■ R&D Organizations

- Do not address technology transfer, insertion and INTEGRATION requirements
- “too much reliance” on technologists who are “sold” on their work; creating “Hype”
- Manages internally developed R&D projects
- A number of research efforts are undirected, unfocused and unproductive.

### ■ Program Management Offices

- TRLs conducted “too late/too few”; S&T Community “Hype” and PM’s “under pressure”
- Does not provide links to related methodologies, such as Spiral Development (SD).
- Addresses only “hard” technologies (hardware, software, etc.), and not “soft” technologies (algorithms, formulas, models, methodologies, work flow, etc.)

# Innovation Management Environmental Issues: DoD R&D and Technology Management

## Environmental Issues should be part of Innovation Management Process Development efforts

### ■ DoD Acquisition Management

- DoDi/FAR 5000.5 - TRLs are single dimension & partially conducted
- Defense Transformation – Business transformation; Cost reduction; Evolutionary Development
- GAO Recommendations – Knowledge-based technology management
- DoD Community suggestions – Multi-level maturity; System-of-Systems (SoS) maturity

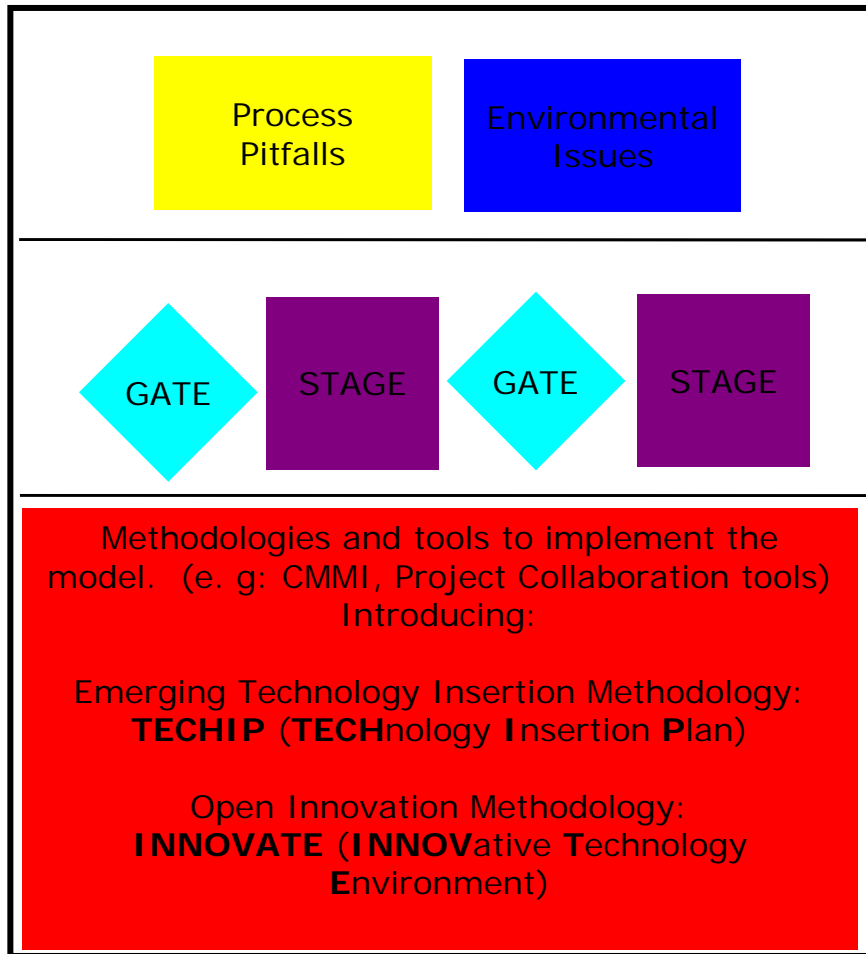
### ■ Industry Best Practices

- CMMI – widely adopted by Government and Industry
- Gate Process – Over 75% major U.S. product developers use some kind of Gate Process
- Hype Cycle – Gartner developed; large private organizations use for technology planning
- Adoption cycle – Technology based organizations use to position their products



# A Proposed Solution: A Gate Process which Addresses Pitfalls & Issues

## An Innovation Management Business Model



■ **BUSINESS MODEL:** A R&D and Technology Management Gate process which addresses .....

- **Process Pitfalls:**  
Generic;  
R&D Organizations;  
Program Management Offices.
- **Environmental Issues:**  
DoD Acquisition Management;  
Industry Best Practices.

■ **AGENDA:**

- Secure Sponsorship & develop plan
- Start with existing practices
- Migrate to a business model
- Communicate & Coordinate
- Track Progress

# Agenda - Recap

## ART to SCIENCE : A Methodology

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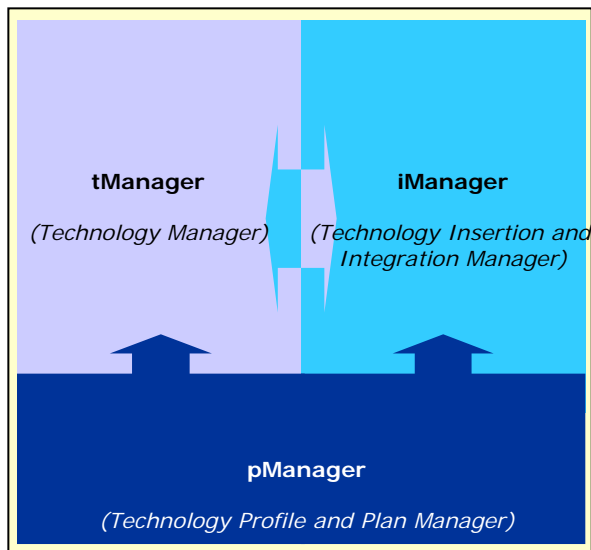
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**IV. Execution:** Strategies to implement the Framework and Process.

# TechIP Methodology: Introduction

**TechIP Methodology consists of two models, tManager & iManager, and associated tools, called pManager**



## ■ What is TechIP?

A knowledge-based Gate process and associated tools that can be used to identify critical research and technology elements, perform multi-dimension maturity analysis, risk assessment, technology insertion and integration activities for the full life cycle of a product.

## ■ Stages/Gates:

Consists of nine innovation gates and stages, named **iGate (Innovation Gate)** & **iStage (Innovation Stage)**

## ■ Components:

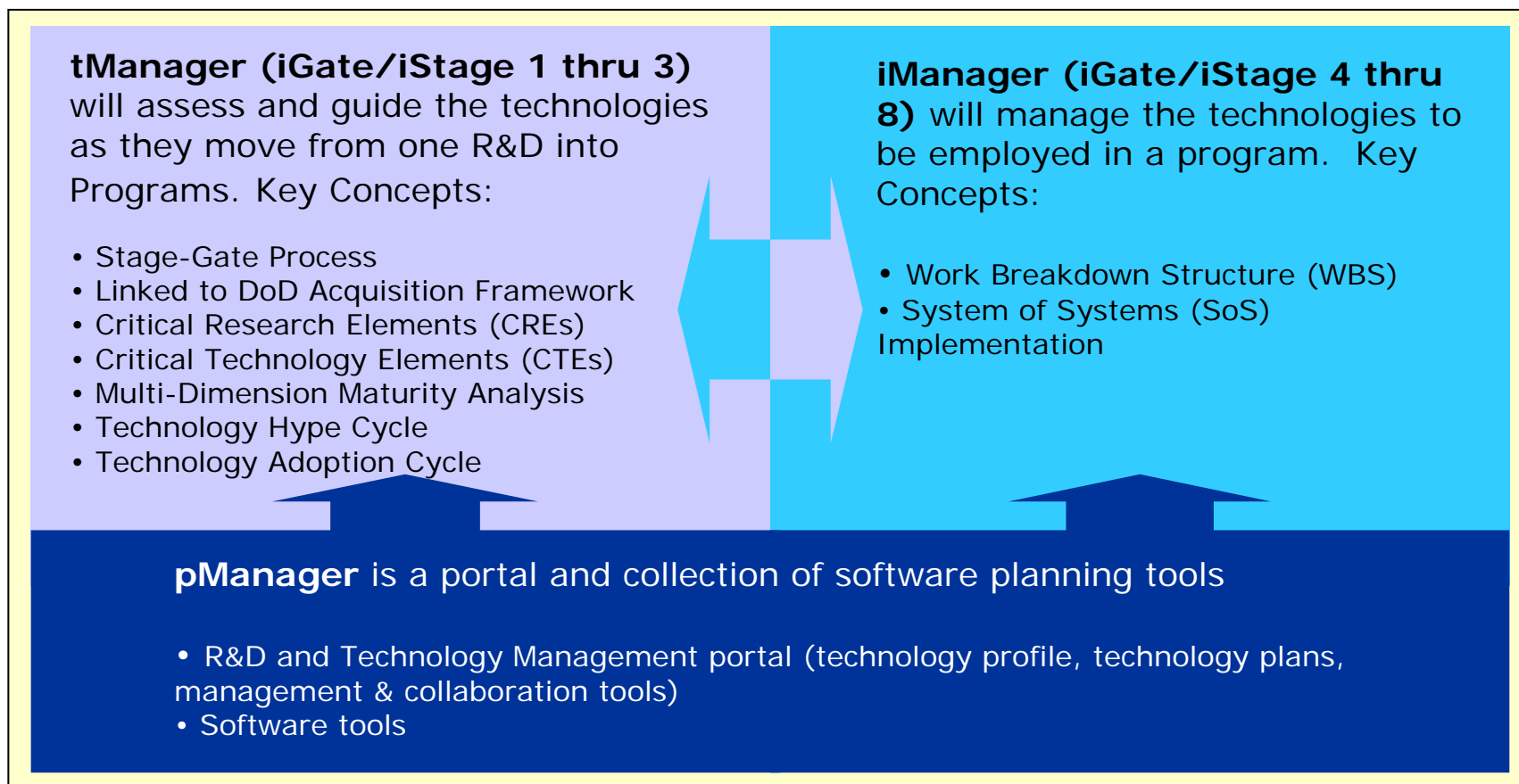
**tManager** (Technology Manager)

**iManager** (Insertion and Integration Manager)

**pManager** (Profile and Plan Manager)

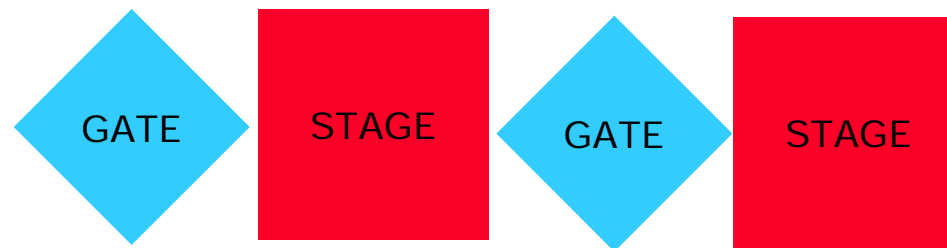
# TechIP Methodology: Components

**TechIP methodology provides a framework for the management of technology through its lifecycle.**



# TechIP : Stage Gate Process

The Gate process is a road map for moving a product from one STAGE to the next, using a GATE as a decision point.



## BENEFITS:

Product/Service portfolio align with organization objectives  
Portfolio has high value and balanced projects  
Projects stay within budget & done on time  
Spending reflects strategy

## STAGES:

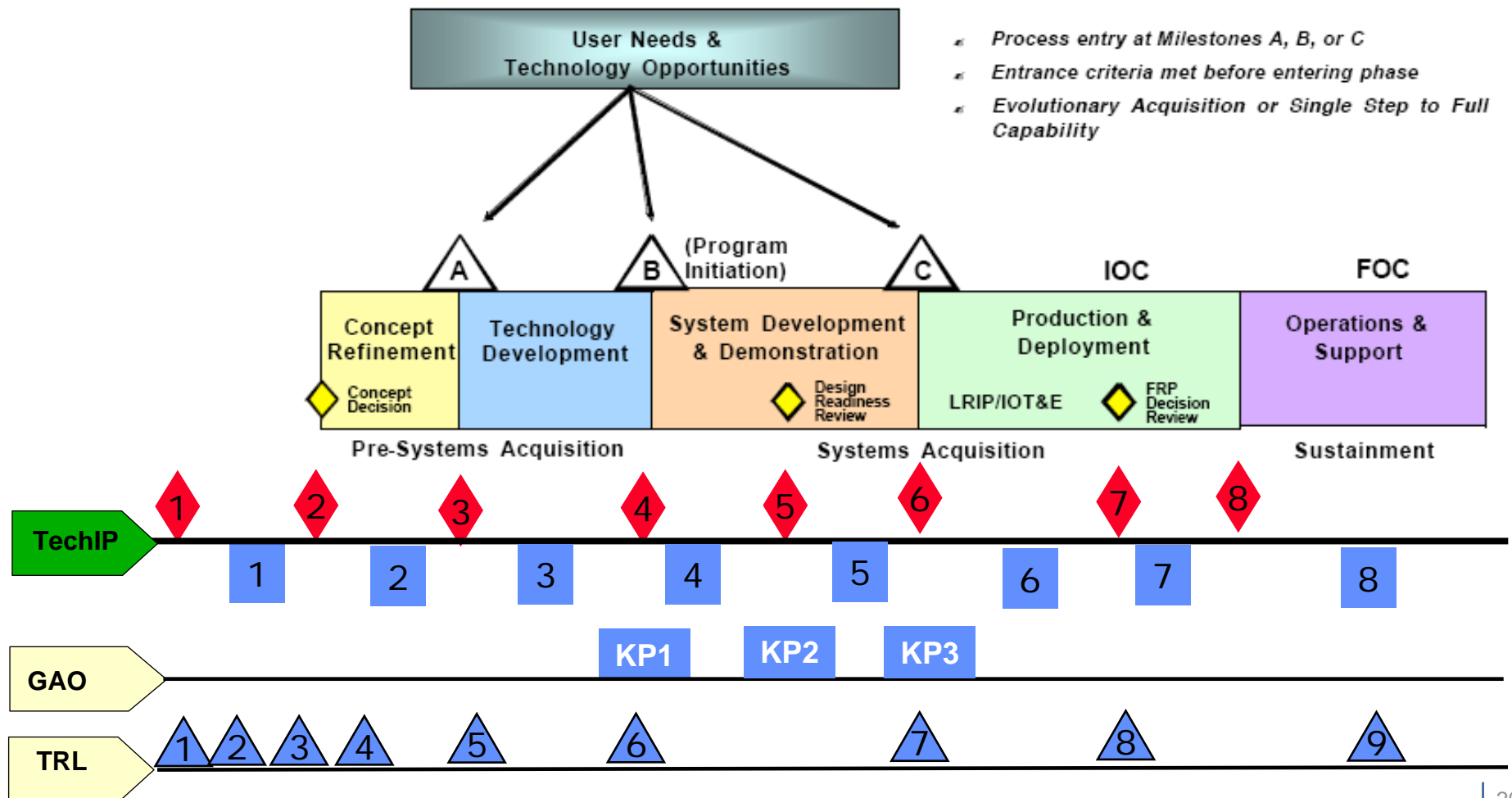
- Stages are where action occurs
- The team players undertake key tasks to gather information needed to advance the project to next point
- Stages are cross functional
- Each stage costs more than preceding stage - risk decreases and investments are allowed to mount

## GATES:

- Quality control check point
- Go/Kill and Prioritization decision points
- Path forward for the next STAGE and resource commitments are decided
- Common Formats:  
Deliverables, Criteria and Output

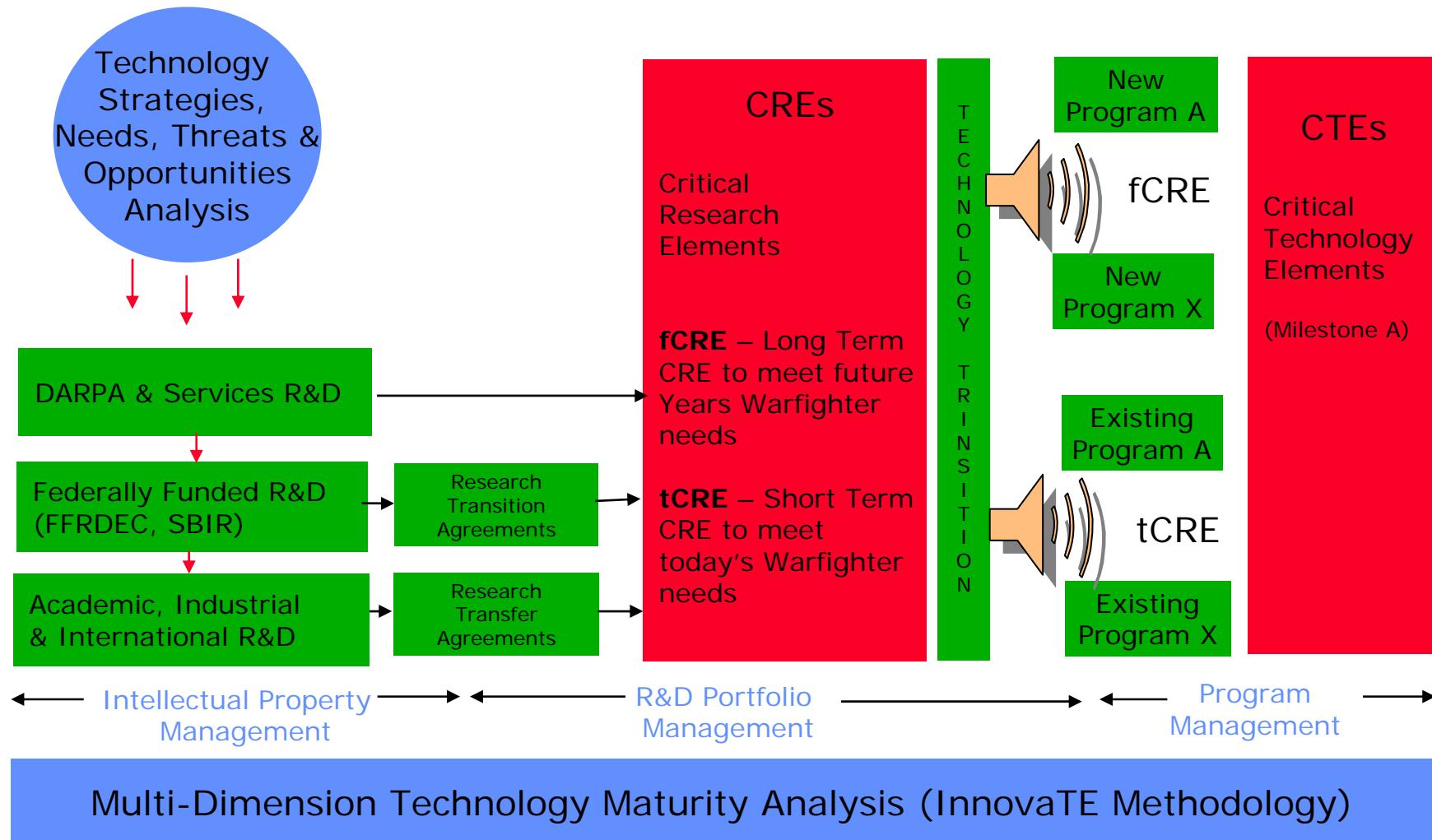
# TechIP & DoD Acquisition Framework

## TechIP steps aligned to the DoD Framework



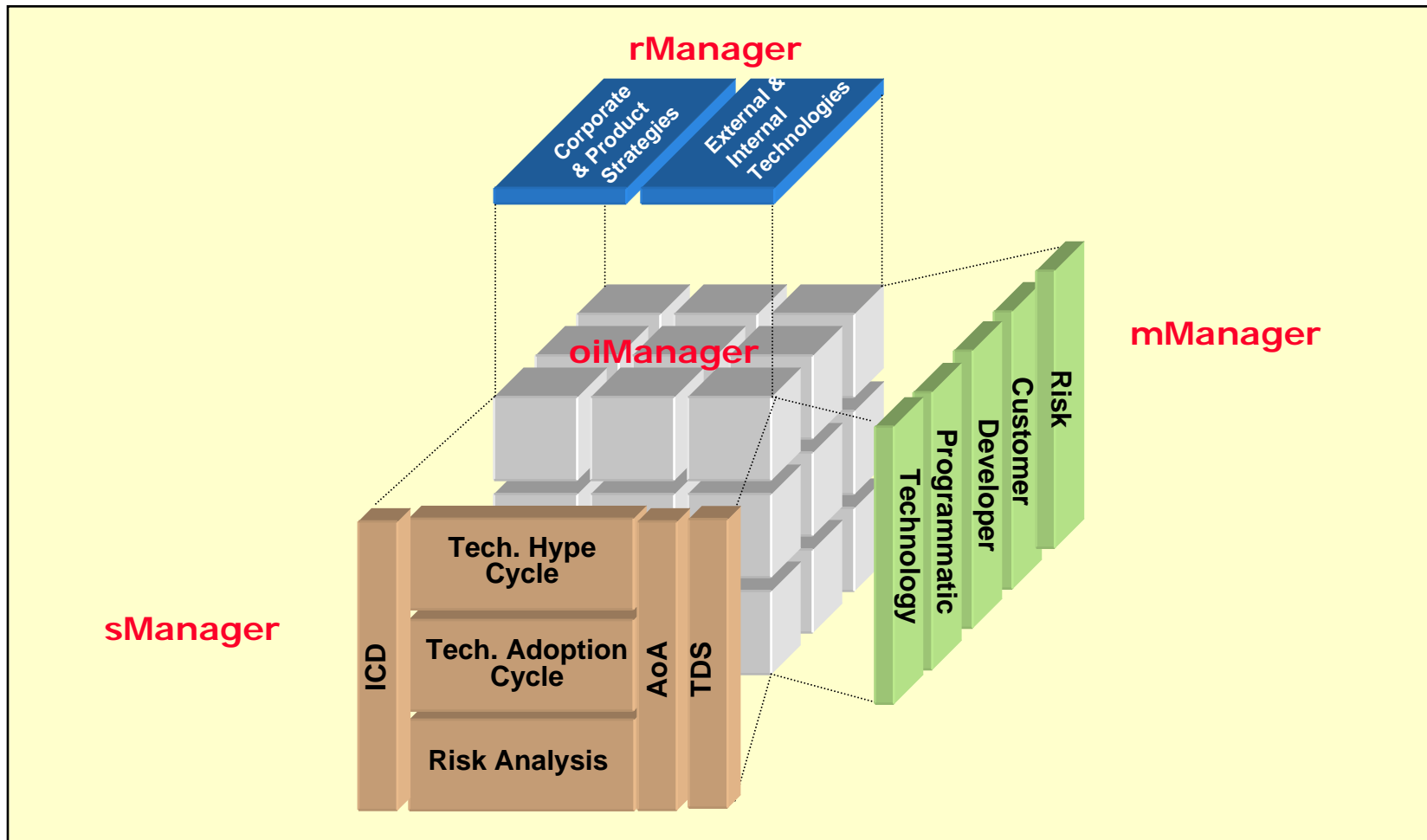
# TechIP: Critical Research Elements

## TechIP links IP, R&D Portfolio and Program Management



# TechIP: Multi-Dimension Maturity Analysis - InnovaTE (Innovative Technology Environment)

The methodology comprises of reviewing user needs and technology opportunities (**rManager**), selecting Critical Technology Elements (**sManager**), conducting maturity analysis (**mManager**), and managing the Open Innovation process (**oiManager**)





## Multi-Dimension Maturity Analysis

### ■ Original Concept

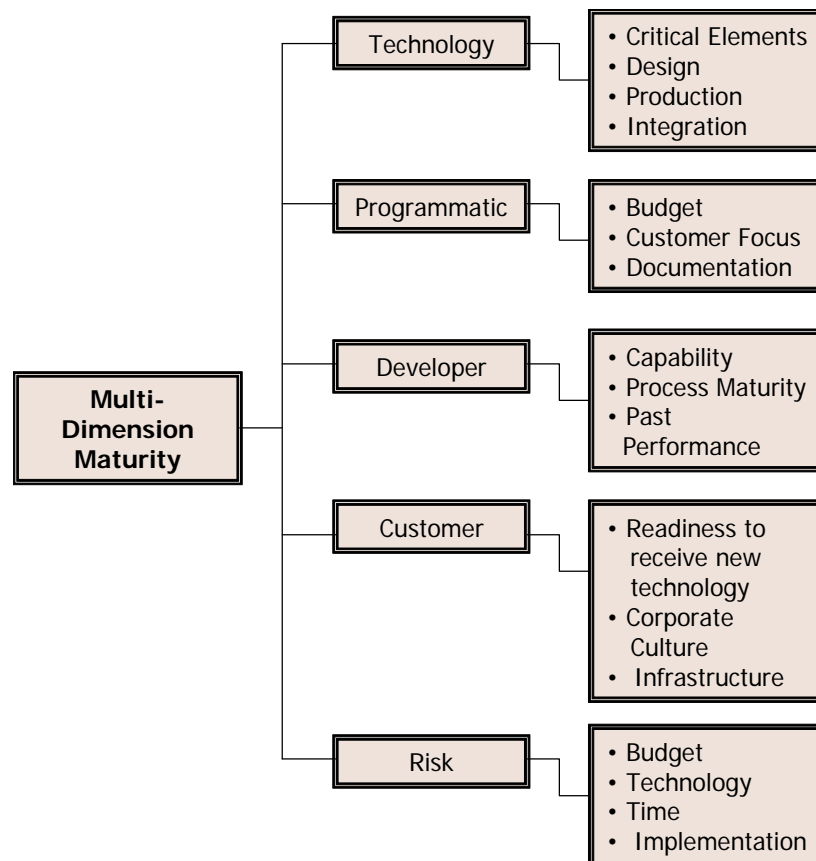
Presented and discussed during the inaugural DoD/NASA wide Technology Maturity Conference, 2006.

### ■ Functions

The purpose of mManager is to perform a systematic, matrix-based, multi-dimensional maturity analysis of the selected CTEs, called SRL (System Readiness Levels).

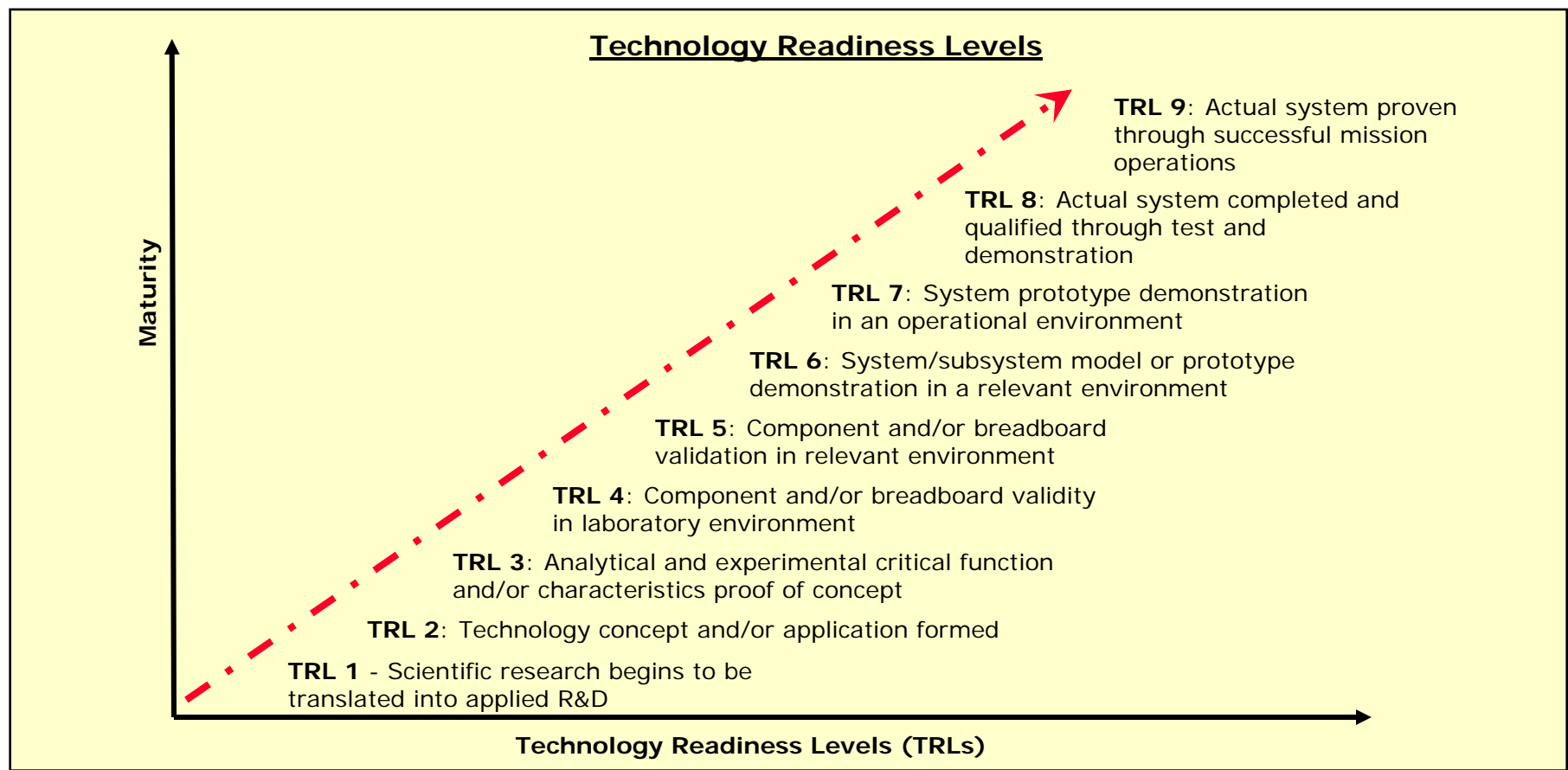
### ■ Result

A multi-dimension matrix, called SRL which is applicable to a Program/Product



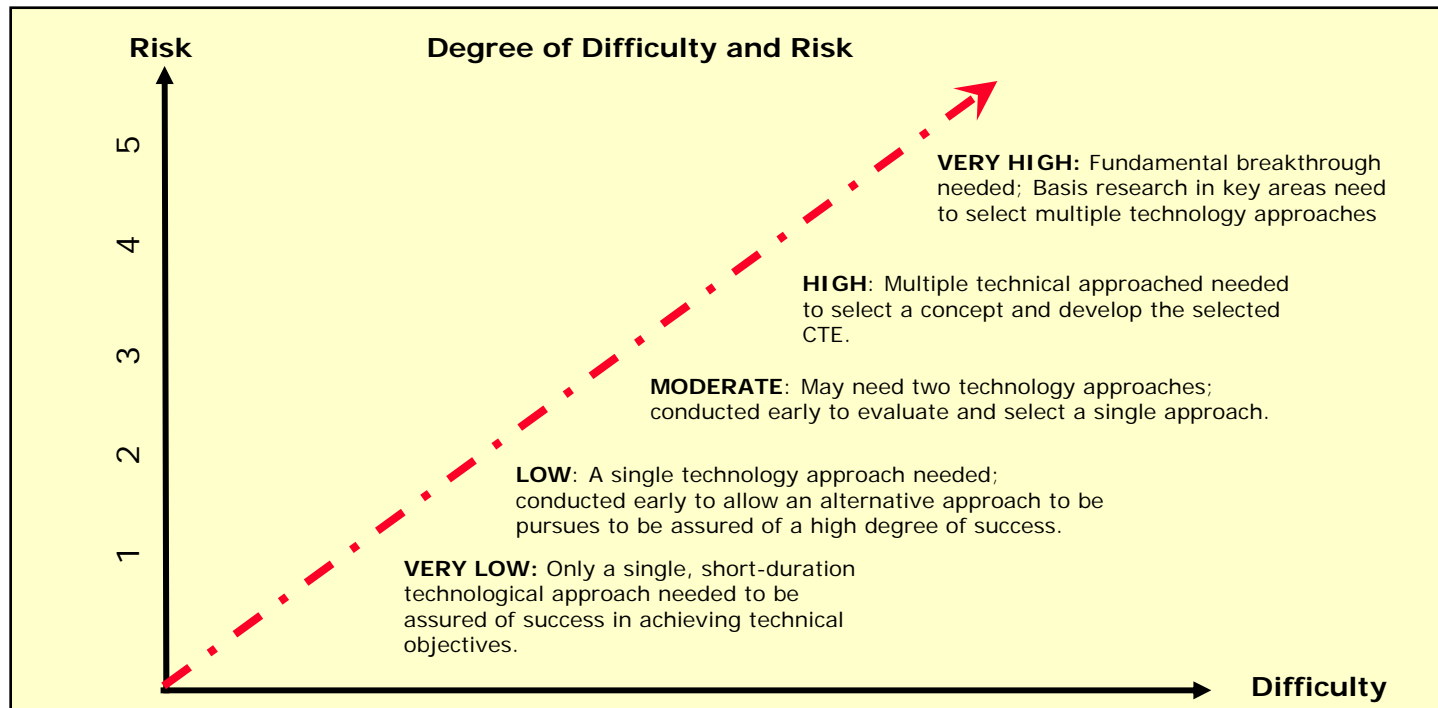
# TechIP: Technology Readiness Levels (TRLs)

NASA developed matrix to classify technology maturity, which is widely accepted by the Department of Defense (DoD)



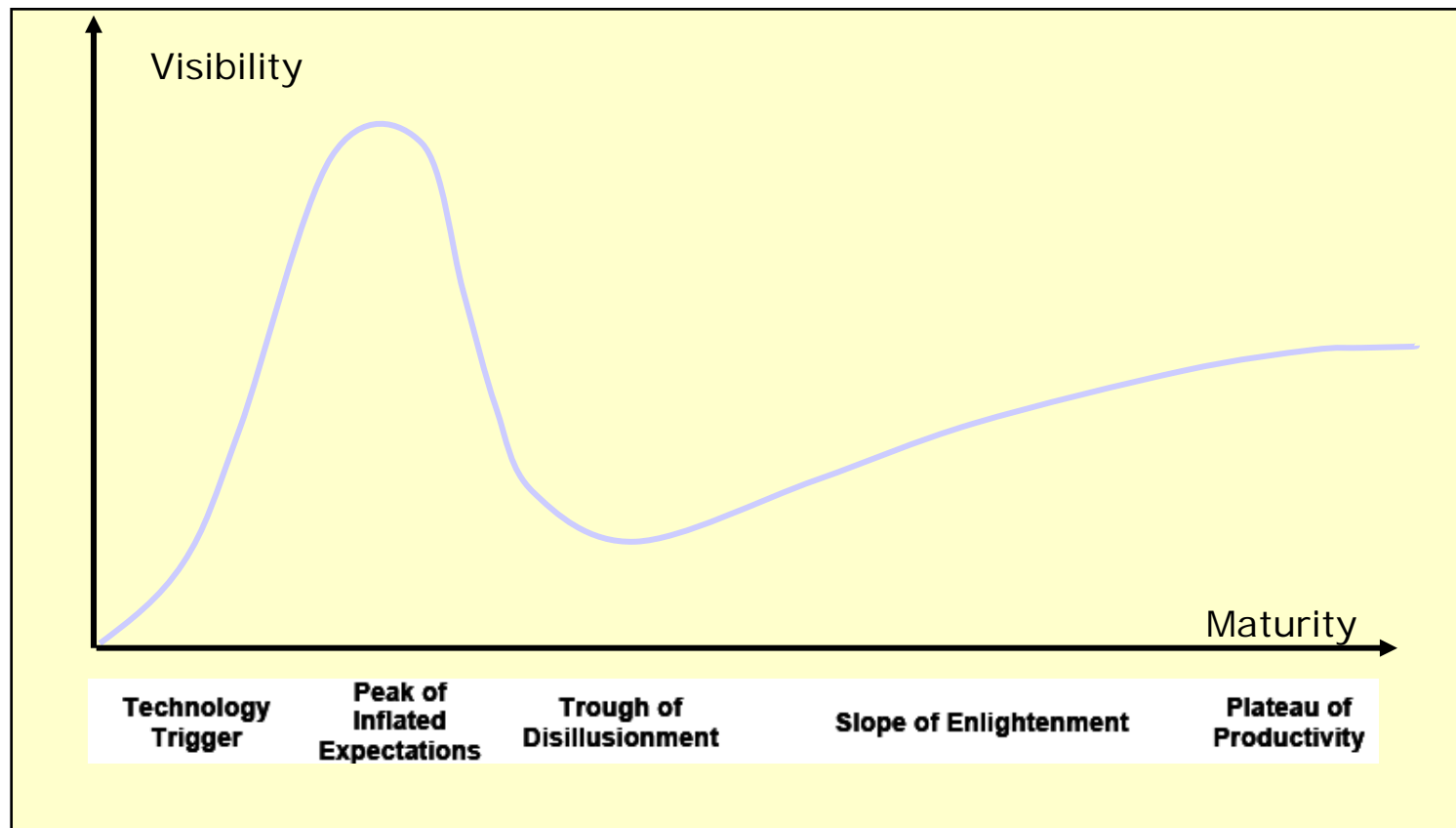
# TechIP: Risk Analysis

Risk Analysis can be used to group IP & R&D Portfolio



# Tech: Hype Cycle

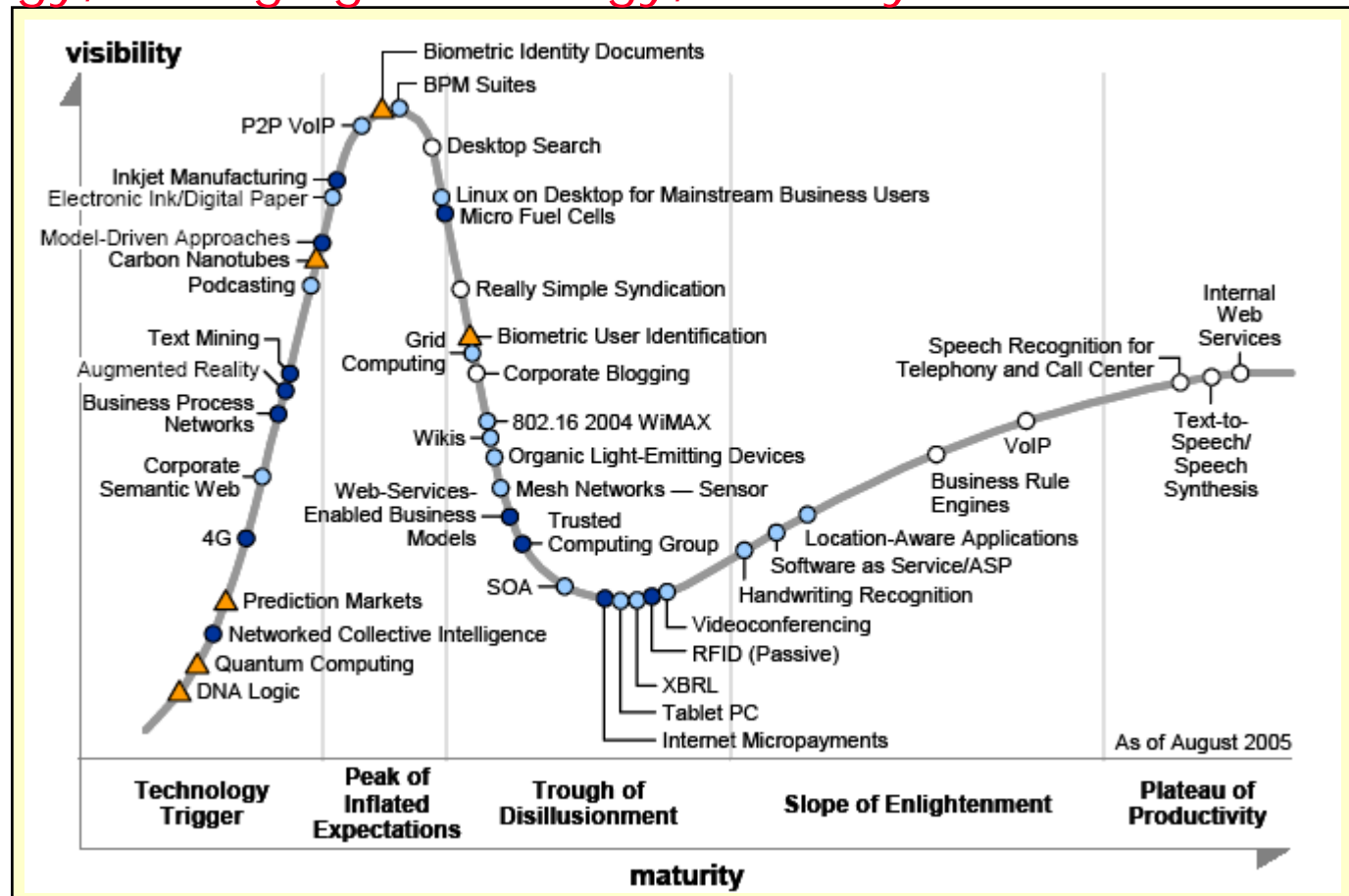
**A Hype Cycle provides a snapshot of technologies, identifying which technologies are hyped, suffering disillusionment, and stable enough to study deployment**



Source: Gartner, Hype Cycle for Emerging Technologies 2005

# Hype Cycle: Gartner's Emerging Technology Elements

Hype Cycles are developed for different domains (e.g: government technology, emerging technology, security assurance technology)



Source: Gartner, Hype Cycle for Emerging Technologies 2005

# Hype Cycle: How to Use

## Early Identification of Emerging Technology: Cuts through hypes and buzzwords

### ■ Develop:

- Generic hype cycles for Internal, External (corporate, Government and Academic) Technology Elements Hype Cycle
- Program specific Technology Elements Hype Cycle

### ■ Analyze:

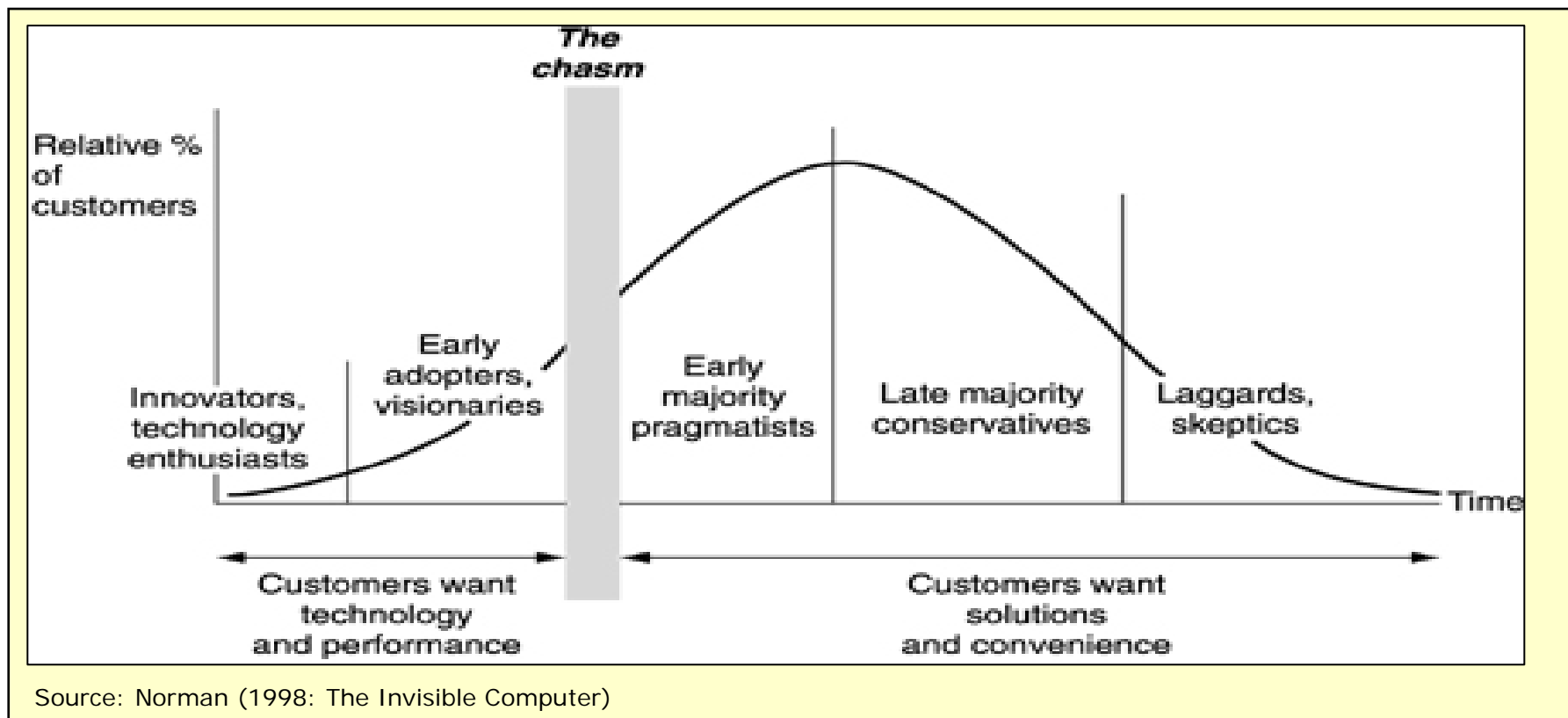
- What are the core technologies? What innovative technologies are available? What are the migration (existing to proposed technology) strategies?
- Develop “Gap Analysis” to understand future technology needs and competitive position.
- Develop technology road map

### ■ Select:

- Use the analysis as an input to IP/R&D/Program Management

# TechIP: Technology Adoption Life Cycle

**Technology developers should be viewed as R&D customers, and End users should be viewed as Technology developers customers**



# Adoption Cycle: How to Use

## Why good technology fail; inferior technology succeed

### ■ Develop:

- Link Technology Maturity to different User types.
  - Early stages – Technology dominates
  - Later stages – Usability, convenience and value
- Role of Technology developers in selecting technologies from R&D
- Role of end users in influencing product development

### ■ Analyze:

- Understand Different User Needs and Position Technology selection and budget to meet their requirements and perceptions.
- Difficulties in adopting disruptive technology
- Link demonstrations and implementations to appropriate User types.
- Innovation in Processes to support selected Technology

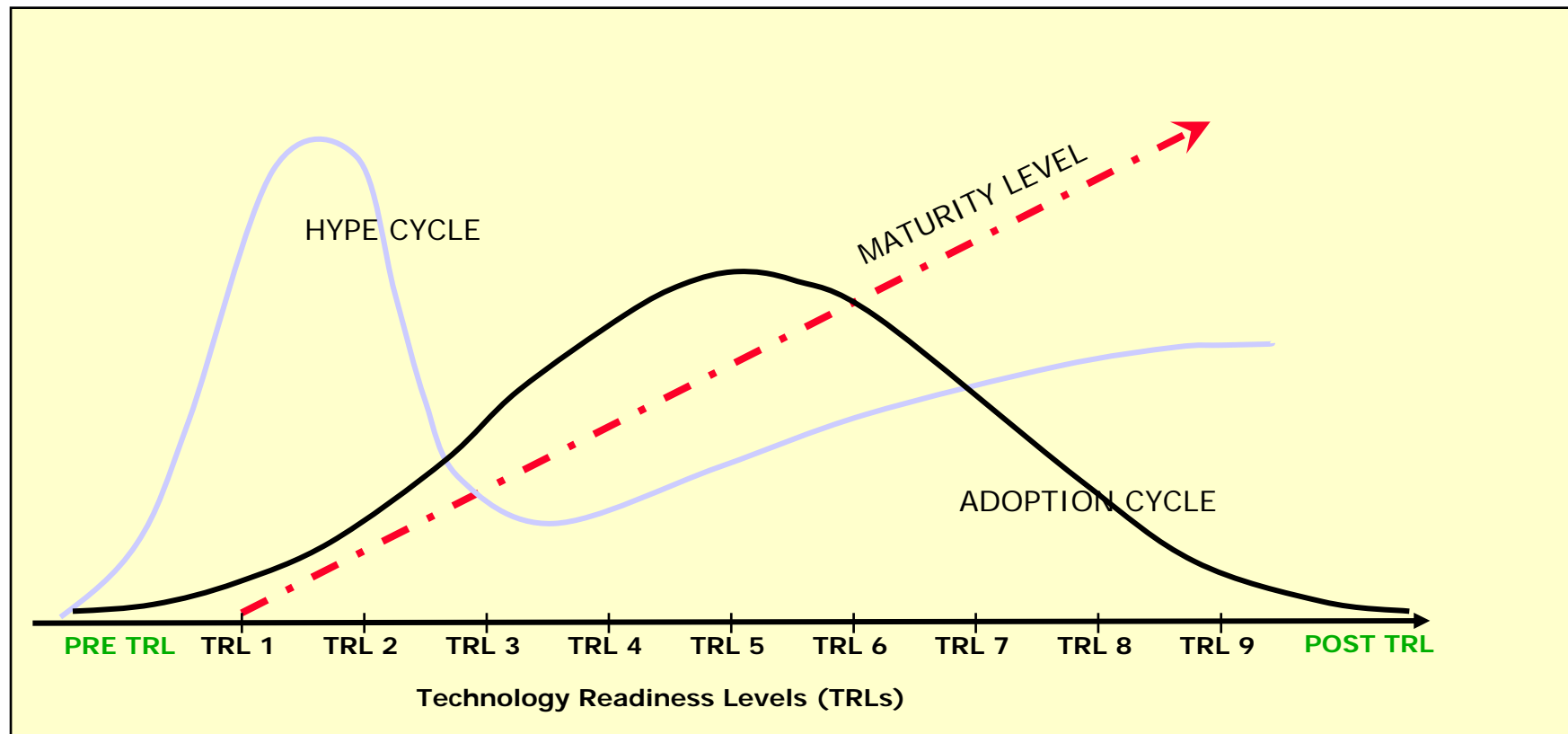
### ■ Select:

- Use the analysis as an input to IP/R&D/Program Management



# TechIP: Analysis of Alternatives

Maturity Levels should be linked to related technology evaluation cycles



# tManager: How to Use

**Technology management should include “best practices”**

## ■ **Develop:**

- Pre-TRL activities
- Post-TRL activities

## ■ **Analyze:**

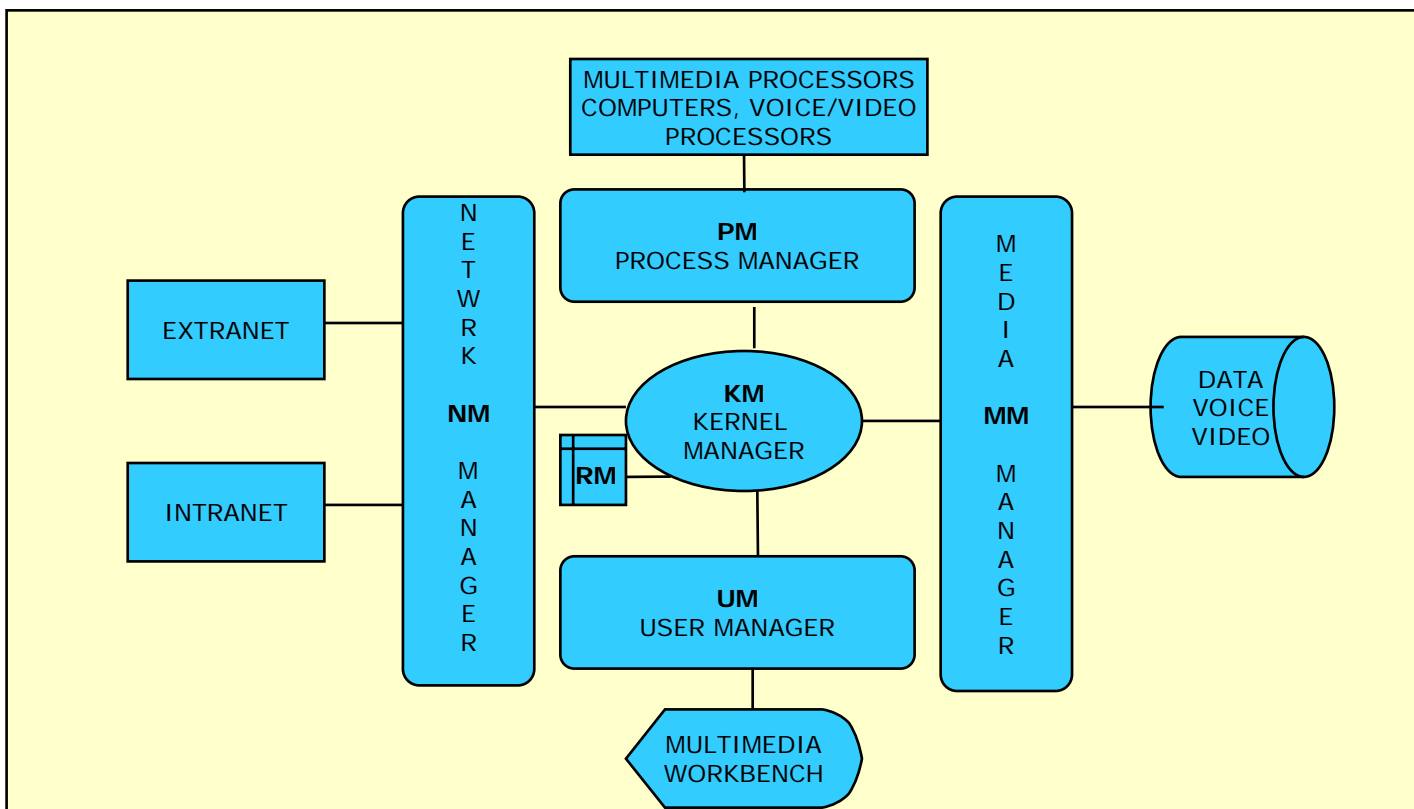
- Technology Cycle results
- Project team incentives (and associated performance requirements) to maintain and implement “Live TDS” through complete product life cycle

## ■ **Select:**

- Incorporate in to TDS

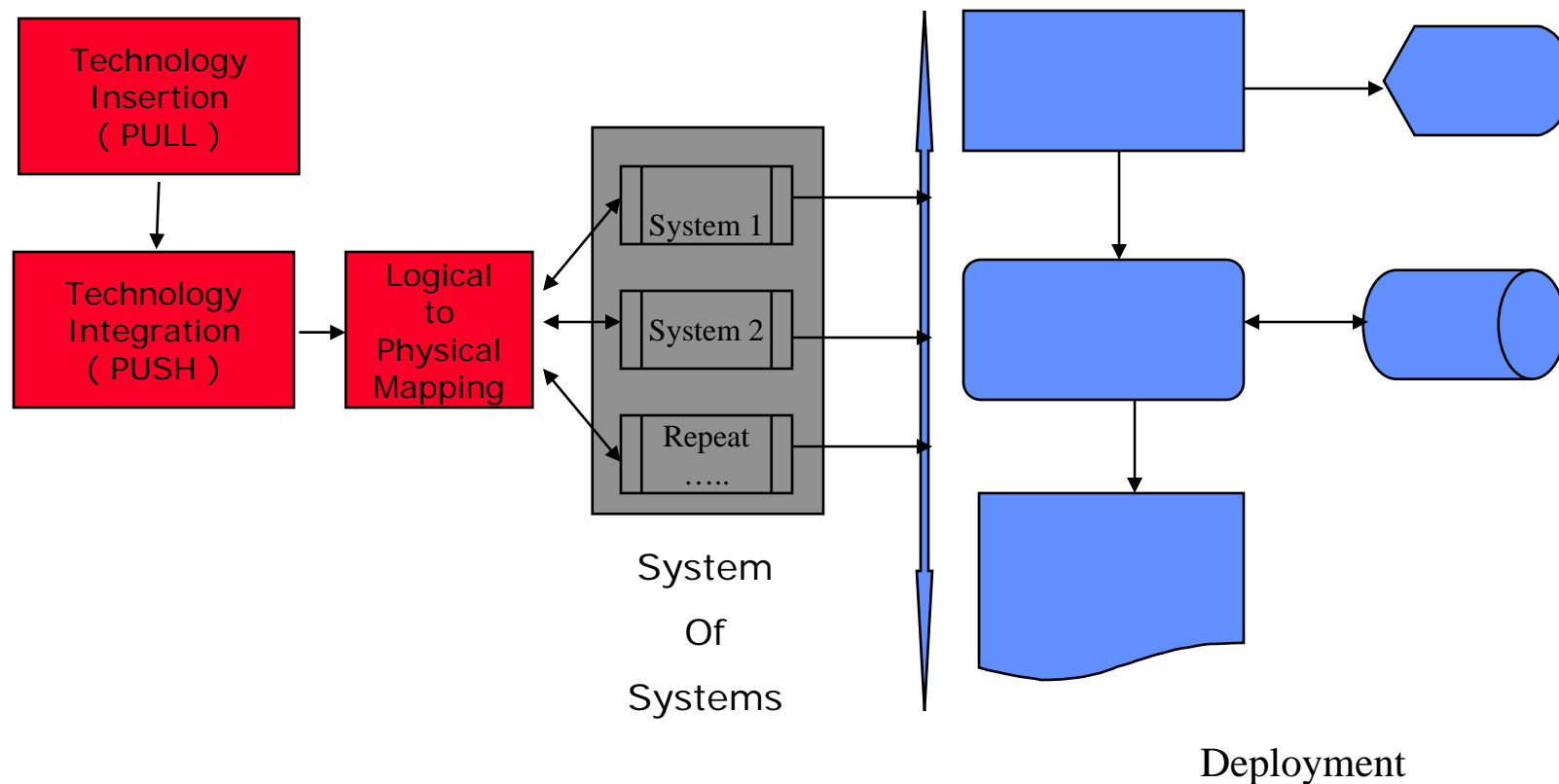
# TechIP: Work Breakdown Structure

**Generic Model (IT System) to map Critical Technology Elements (CTEs) into a product**



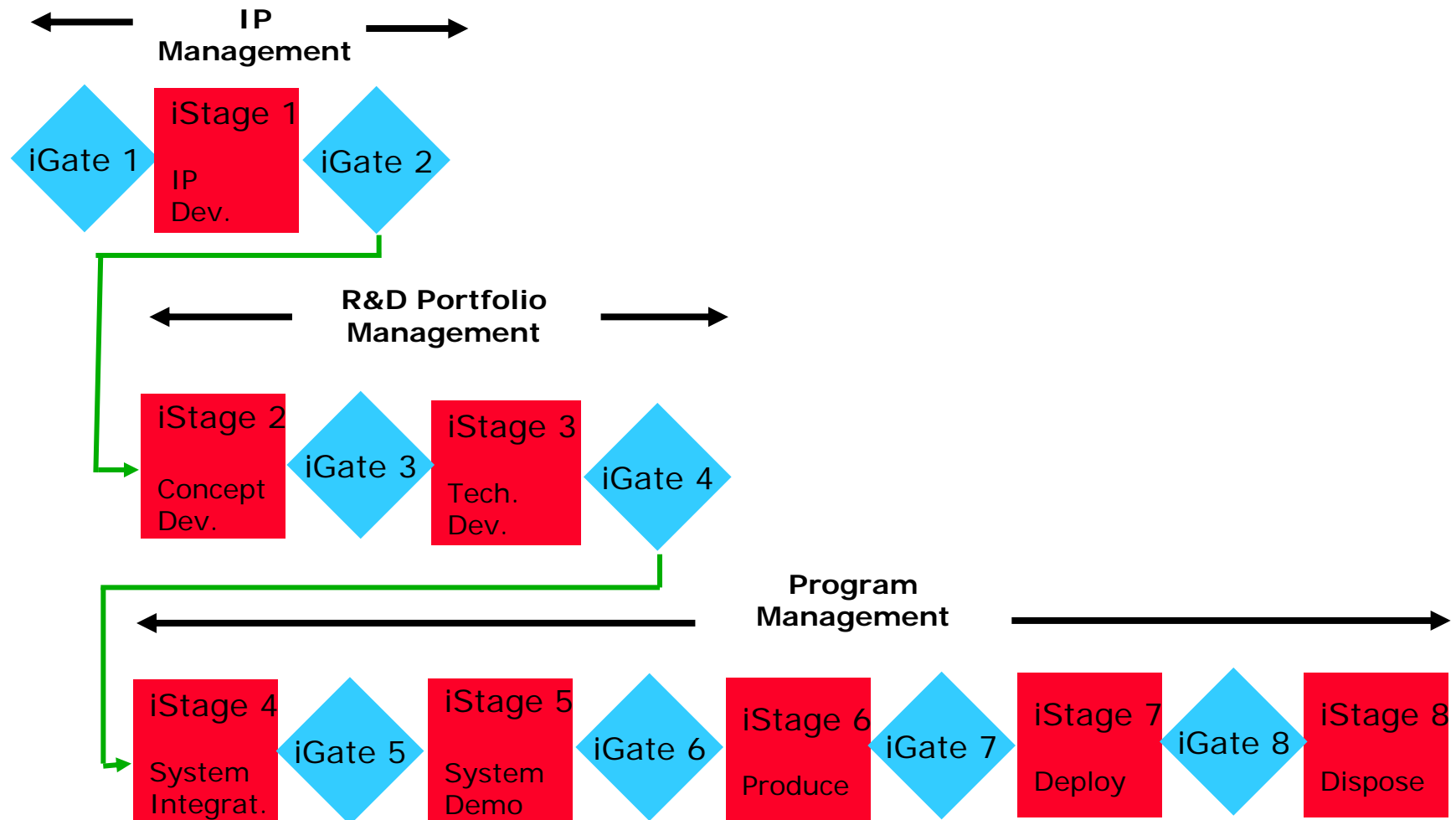
# iManager: Technology Insertion & Integration Activities

Create a Technology specific iManager model by PULLing CTEs from tManager; create iManager models for each system component of a product, and integrate these CTEs in to the product by PUSHing into individual systems.



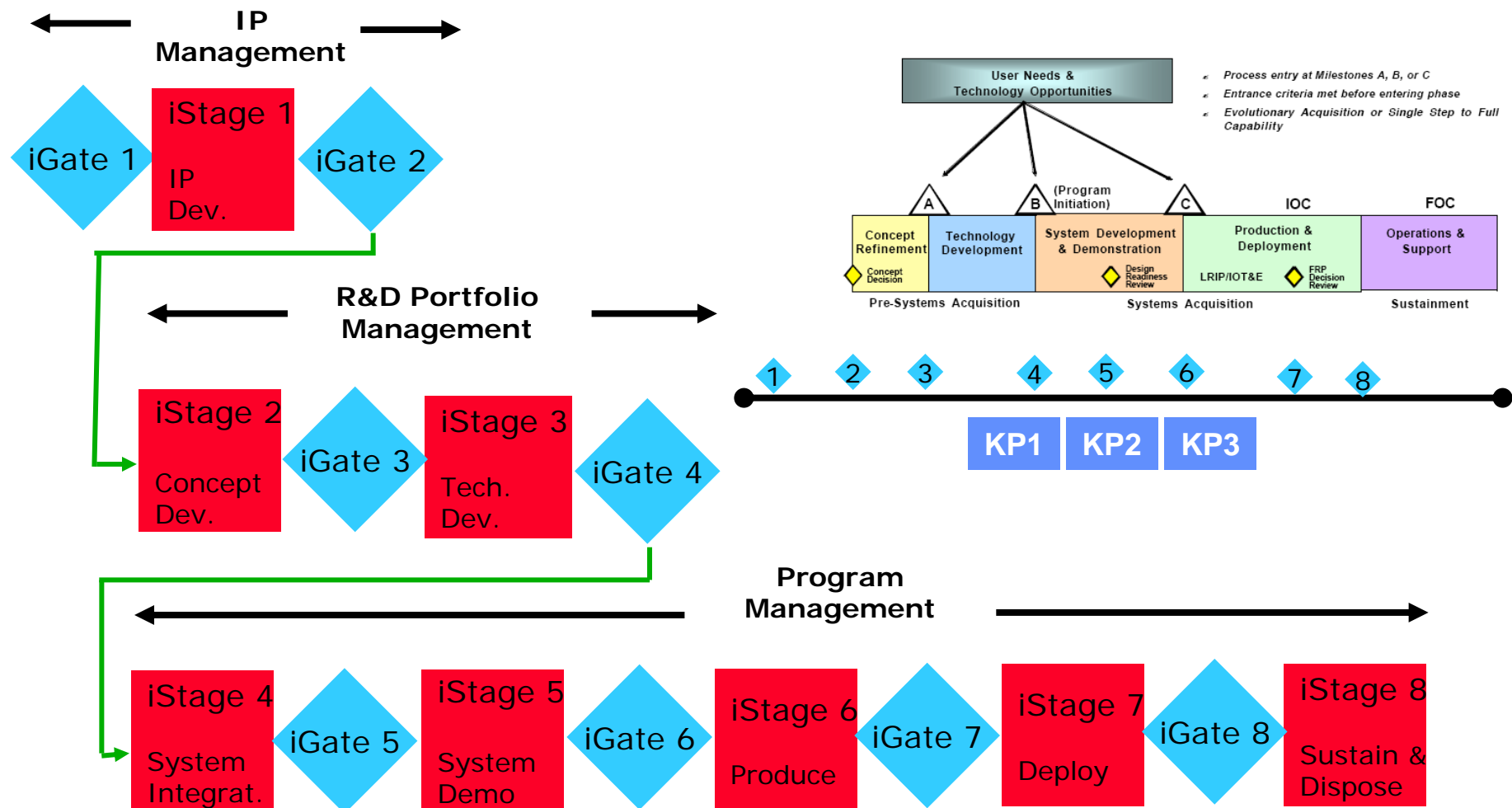
# TechIP: iGate/iStage Framework

IP, R&D Portfolio & Program Management should be linked



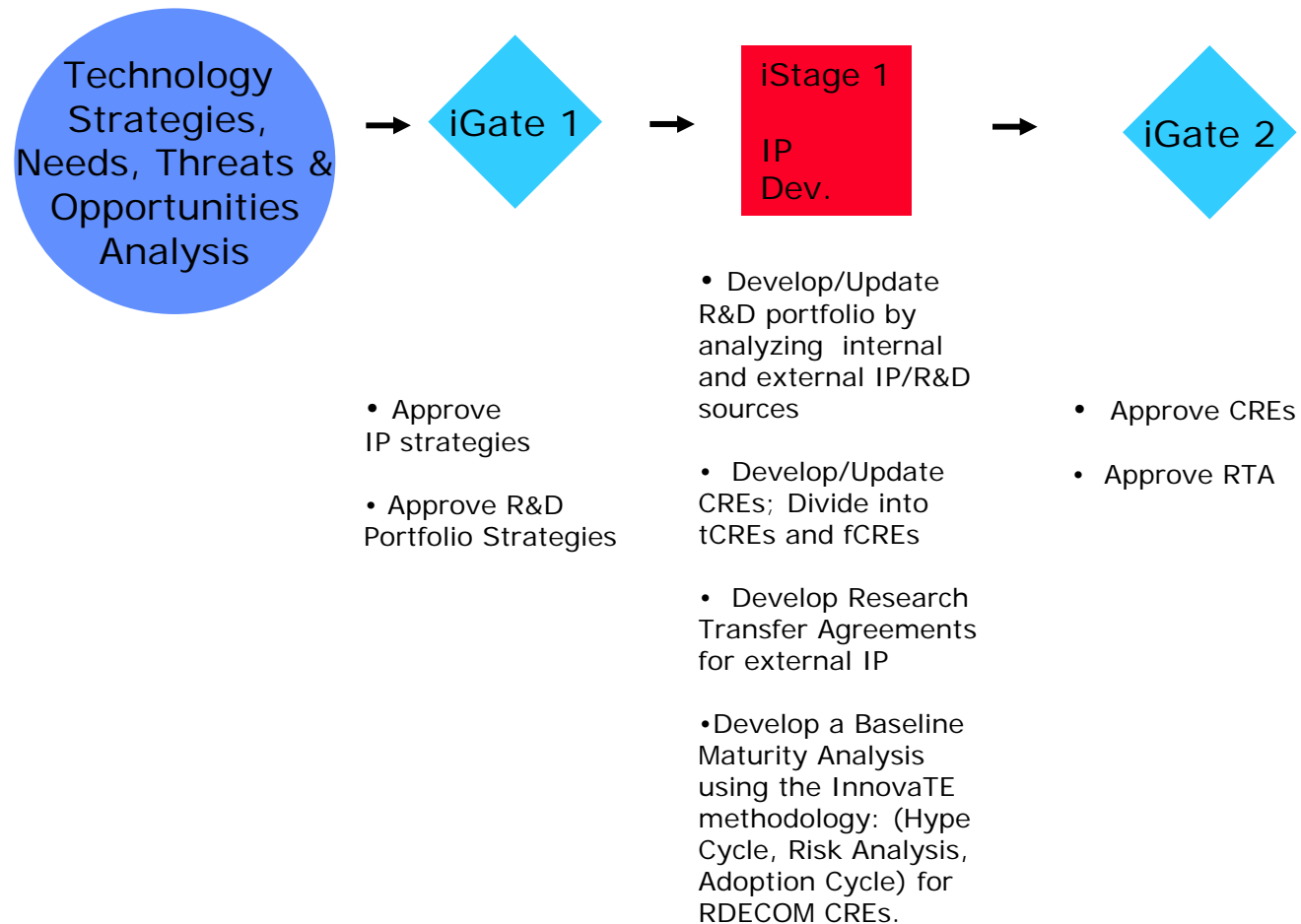
# TechIP: iGate/iStage Framework

## iGate/iStage & DoD Acquisition Management Framework



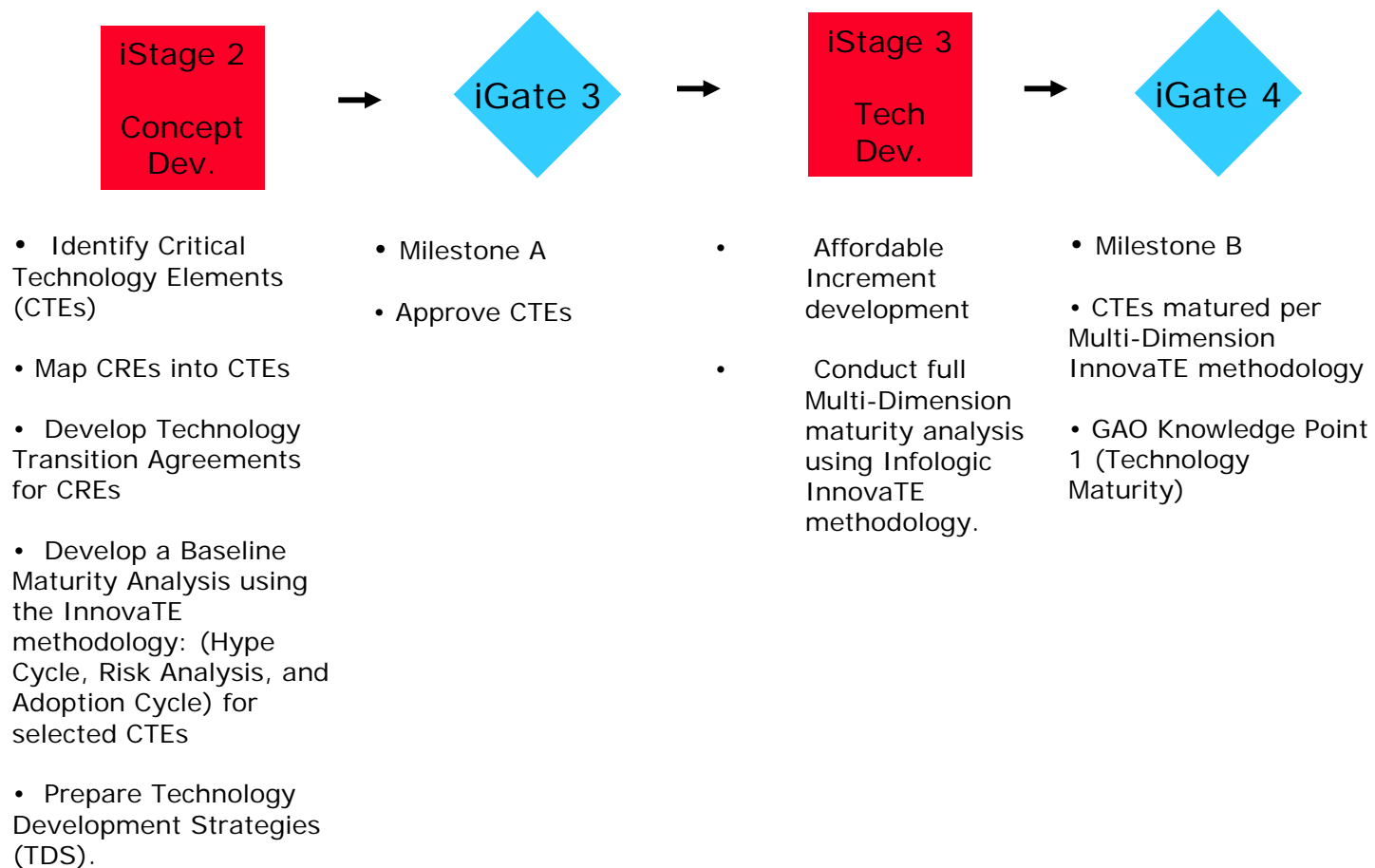
# TechIP: IP Management

## IP Management: iStage 1



# TechIP: R&D Management

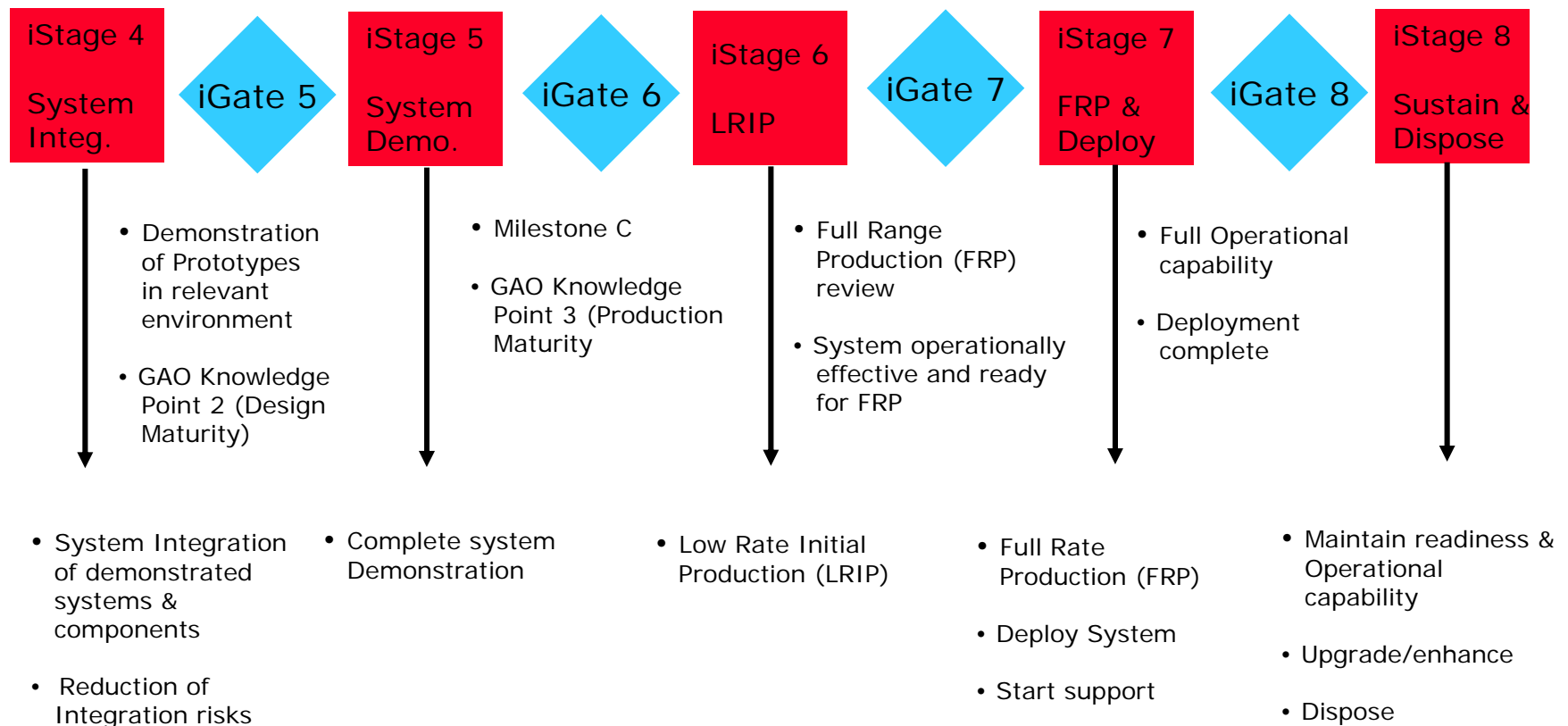
## R&D Portfolio Management: iStage 2 and iStage 3





# TechIP: Program Management

## Program Management: iStage 4 thru iStage 8



# pManager : Overview

The objective of pManager (which is a set of processes and software tools) is to manage the technologies identified by the tManager and iManager components of TechIP

<b>Technology Profile</b>	<ul style="list-style-type: none"><li>• Metadata (definitions) of CEs, systems, subsystems, etc.</li><li>• Live Technology life cycles</li></ul>	<b>Technology Plans</b>	<ul style="list-style-type: none"><li>• Live TDS</li><li>• Technology Roadmaps</li><li>• Technology Migration Plans</li><li>• Technology Maturation Plans</li></ul>
<b>Management &amp; Collaboration</b>	<ul style="list-style-type: none"><li>• Project Management</li><li>• Collaboration Platform</li><li>• CMMI</li></ul>	<b>Tools</b>	<ul style="list-style-type: none"><li>• GOTS (e.g; AFRL TRL Calculator)</li><li>• COTS (e.g: Infologic InnovaTE)</li><li>• Technology Portal</li><li>• Modeling and Simulation</li></ul>

# Agenda: Execution

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# Business Model Implementation Agenda

## Convert the ART of Innovation Management into SCIENCE

### ■ Secure Sponsorship & Develop Plans

- Senior executive & line management, and R&D management commitments
- Develop a business model and associated implementation plans

### ■ Start with Existing Practices

- Align existing “best practices” (e.g.: TRLs, CMMI, Six Sigma) and software tools with the new business model, and put “teeth” and “rewards” into these practices

### ■ Migrate to a Business Model

- Develop or acquire necessary tools and processes to fully implement the model

### ■ Communicate & Coordinate

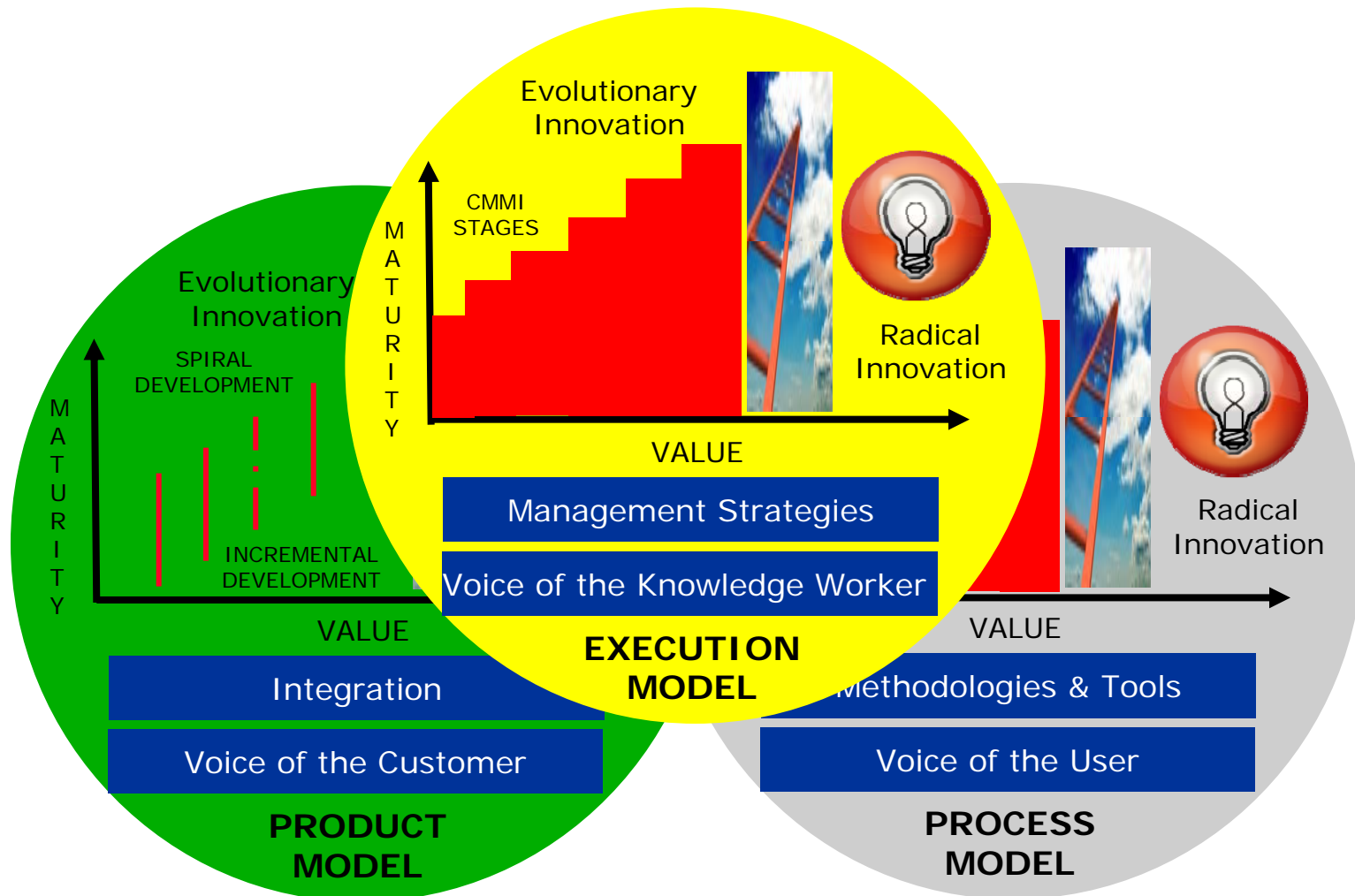
- Keep all stockholders in loop

### ■ Track Progress

- Continuously “perfect” the model by adding values to your “best practices” processes and eliminating “wasteful” processes.

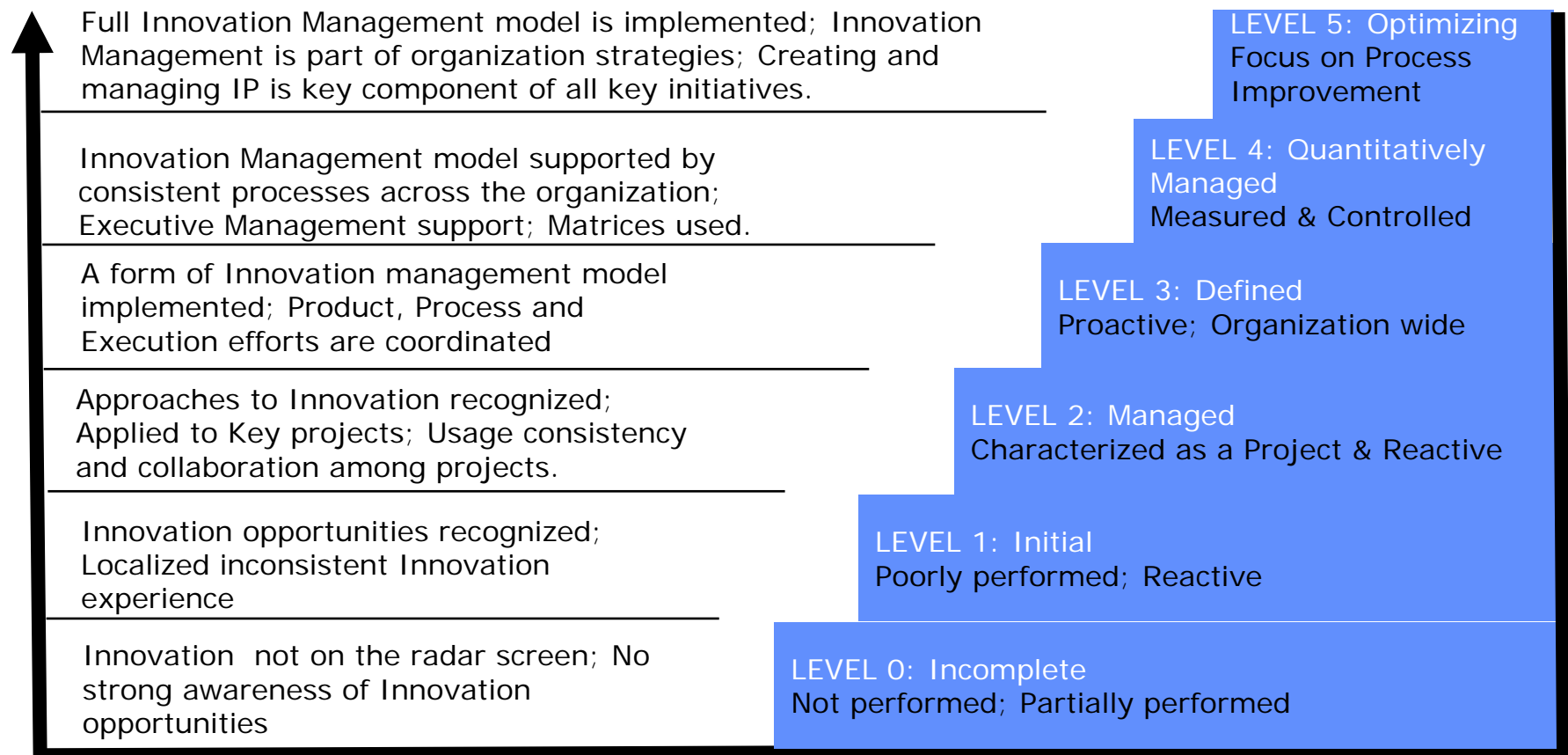
# Goal: Innovation Management Model

**Innovation Maturity = f (Product, Process, Execution)**



# Execute: Innovation Management Model

**Innovation Management is a Process and should be matured using the CMMI methodology**



# Agenda to Conclusions

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## A Final Word

### **Innovation Management – Rocket Science ?**

**“Innovation doesn’t just happen because it is directed or discussed or considered to be an imperative; innovation happens because organizations commit to the disciplines, practices, culture and processes that support and sustain innovation”**

Gartner - Managing Innovation: Primer, 5/2006

**WILL TO ACT & EXECUTION is a Rocket Science!**

**Call to Action:**

**Don’t just EMBRACE Innovation Management,  
but EXCEL in Execution by converting the ART  
of Innovation Management in to SCIENCE !**



# Open Innovation and Technology Maturity Analysis

**U.S. Department of Defense (DoD)  
R&D and Technology Management**

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I Rest My Case !



**I N F O L O G I C**  
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